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A New Species of *Tectocepheus* (Acarina, Oribatida) from Japan

With 3 Text-figures

Norihide OHKUBO

Suzuka Agricultural Extension Office in Mie Prefecture,
Kôda-cho, Suzuka, Mie 513, Japan

ABSTRACT A description of *Tectocepheus elegans* sp. nov. is given. The new species is distinguishable from its known congeners by having a fence-like rostral appendage. Many other morphological characters of this species are described in detail in order to clarify the complicated taxonomy in the *Tectocepheus* species.

Several *Tectocepheus* species may perhaps dwell in Japan, though only two species, *T. velatus* and *T. cuspidentatus*, have so far been identified. There are few discriminative features described for *T. velatus* and its related species, while the other members are distinguishable by characters of only a few parts such as lamella and rostrum (KNÜLLE, 1954). In many cases, the structure of prodorsum is not well understood. The reason for this complication in the taxonomy of *Tectocepheus* may be partly in that the morphology of these species has not yet been well recognized. Therefore, the morphology must be clarified in order to solve the complicated taxonomy of this group. Descriptions of *T. bisignatus* by MORITZ (1968) and *T. minor* by BERNINI (1973) presented us useful information on fairly detailed morphology of these species. Then the author adds one more detailed description based on a species which is easily recognized to be new to science on its peculiar prodorsal features.

Tectocepheus elegans sp. nov.

[Japanese name: Kakoi-kuwagatadani]

(Figs. 1–3)

Tectocepheus velatus: AOKI, 1977, p. 204, fig. 82 left.

Dimensions. Length for 12 specimens: 275(301)315 μ. Width for 9 specimens: 170(175)180 μ.

Rostral appendage. A highly-developed, fence-like appendage mounting on rostrum and completely covering it. It is a high, plate-like wall. The upper edge of the wall hemmed by a sclerotized hand-rail. The edge looks like a square bracket in dorsal view; its anterior part almost straight or slightly crooked, while its lateral parts almost parallel to each other though slightly converging posteriorly. Each lateral part of the edge in lateral view cornered with an obtuse angle near posterior end. The wall supported by two pairs of ridges anteriorly and laterally. The anterior ridge sigmoid, starting near rostral tip and ending near an anterior corner of the upper edge (Fig. 1 C). Lower parts of the two anterior ridges draw near to each other. One or two small protrusions between them on rostral tip. The lateral ridge thicker, continued from a ridge where rostral seta arises. ending also near the anterior corner of the upper edge of the wall. The anterior part of the wall leans forward between two anterior supporting ridges. Its distal surface with a few, round, medium-sized granules. Granules also found along the upper edge of the wall.

Rostrum and lateral part of prodorsum. Rostral margin smoothly rounded without notches between rostral setae (Fig. 1 B). It is strongly rimmed there (Fig. 2 A). The rim forming a sclerotized frame of camerostome. The rostral frame surrounds only rutella, so that the ramaining mouth parts behind rutella are surrounded by podosomatic portion.

In lateral view, the rostral frame becomes a ridge when withdrawn from camerostome at genalincisure *cis*. The ridge gradually changed into a carina (anterior carina) which arcs and is extinct above acetabular tectum I. Therefore, the carina may be a border between aspidosoma and podosoma. Rostral seta arising on a swollen ridge that is derived from rostral frame. The setal ridge further branching upward and backward. The former branch supporting the lateral wall of rostral appendage as mentioned before. The latter extends to the posterior end of the appendage. Rostral seta directed forward, exceeding rostral tip, but not reaching the anterior margin of rostral appendage. The seta finely pointed at tip with dense but obscure barbation on antiaxial side of the basal half.

Behind the anterior carina are found two more carinae, upper and lower. Upper carina sigmoid, beginning above anterior carina and ending near bothridium. Lower carina shorter, beginning above acetabular tectum I and ending near the posterior end of upper carina. Tutorium absent. Lateral side of prodorsum fairly concave between the upper carina and the base of lamella. Prodorsal surface roughly wrinkled above upper carina, almost smooth but with large obscure network between upper and lower carinae, and slightly granulated under lower carina (Fig. 2 B).

The region behind bothridium darkened because of an internal process which may be the posterior border of aspidosoma (Fig. 2 A). The process is a long, acute, projection (Fig. 3 C).

Bothridium. Upper bothridial scale retuse, attaching lamellar costa and protruding from it. The posterior part of the scale covered by humeral process. Lower bothridial scale ridge-like, not so protruding from the prodorsal surface as the upper one. Lower scale bent medially. The whole contour of the two bothridial scales spindle-shaped. There are two exobothridial ridges. Anterior exobothri-

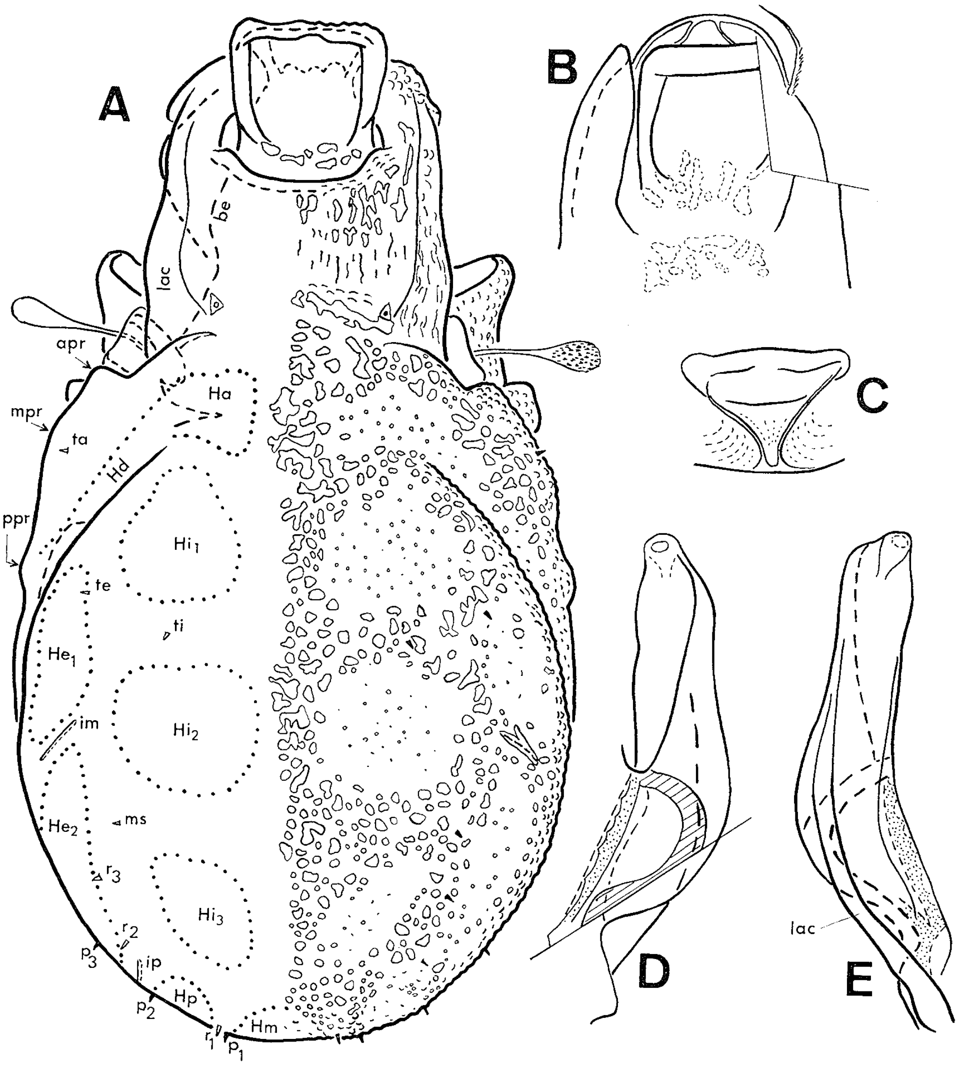

Fig. 1. *Tectocepheus elegans* sp. nov. —— A, Dorsal aspect; B, anterior region of prodorsum in anterodorsal view; C, rostral appendage in front view; D, lamella in paraxial view; E, lamella in antiaxial view. (apr, anterior projection; be, base of eaves; lac, lamellar costa; mpr, median projection; ppr, posterior projection).

dial ridge thick and long, strongly sclerotized, extending downward from a posterior part of lower bothridial scale. A basal portion of sensillus buried at an upper part of this ridge. A posterior exobothridial ridge small, hooked and less strongly sclerotized; it is sometimes separated into two portions. Exobothridial seta minute, growing on the anterior part of the posterior exobothridial ridge.

Bothridium open anterolaterally. Sensillus directed anterolaterally at first, then elbowed upward. Its depressed clavate head with dense barbation. Head as thick as peduncle, so that sensillus sometimes looks like a stick without swollen part (Fig. 2 C).

Lamella. Broad eaves overhanging from both lateral sides of prodorsum, sheltering legs I when legs are drawn up. The base of the eaves sigmoid, observable through prodorsal integument in dorsal view. Cuspis free from the prodorsal body at a translamella-like structure. Therefore, the eaves are compounded by lamella, cuspis and prodorsal body proper which are difficult to be separated from one another. A conspicuous "lamellar costa" running longitudinally on the eaves. The costa touching notogaster posteriorly, occupying all space between bothridium and interlamellar seta, and gradually tapering anteriorly toward cuspis. Though its anterior end seems to touch the tip of cuspis in dorsal view (Fig. 1 B), it dose not really reach there (Fig. 1 E). The posterior part of the costa thin plate-like with granulation, looking like a true lamella. On the eaves, there is a part of prodorsal body inside of lamellar costa. Posterior half of that part concave, while the anterior half is elevated to extend toward cuspis. On the elevation, a short, slightly sclerotized ridge exists near false translamella, running parallel to lamellar costa. There is a narrow ridge along the base of eaves. Its posterior end disappears on the underside of the eaves, while its anterior part changes into an exterior lateral margin of cuspis.

Cuspis long, with its tip sheltered by rostral appendage. Its surface covered by thin granulated membrane. Cross section of cuspis U-shaped in reversal view. Interior lateral margin of cuspis is observable from dorsal view to be slightly expanded. Exterior lateral margin also expanded but fairly curled inward. The tip of cuspis blunt with a small expansion where lamellar seta arises. The tip without acute processes.

Lamellar seta pointed at tip, with dense but obscure barbation on the basal half. The barbation is only seen on the antiaxial side. The seta directed inward, scarcely reaching the opposite lamella. Whole setae sheltered under rostral appendage.

Dorsal side of prodorsum. The translamella-like structure is a mere cliff steeped behind rostral appendage. Transverse shadow of the cliff in dorsal view (Fig. 1 A) will disappear when a specimen would be observed in anterodorsal view (Fig. 1 B). There is neither sclerotization nor ridge at the cliff. The cliff therefore must not be called translamella, as the true translamella is absent. The cliff is fairly high, with its upper edge arched backward. There are no granulation on the cliff except on its upper edge.

Prodorsal field between cliff and dorsosejugalis strongly waving up and down. Its anterior half convex with large longitudinal rows of irregular granules, then the field behind it concave with longitudinal rows of wrinkles and finally the field in front of dorsosejugalis re-elevated to the same level as notogaster with a transverse row of large irregular granules. Interlamellar seta bud-like, minute, growing on a small sclerotized ridge which is situated just near dorsosejugalis and just inside of lamellar costa.

Notogaster. There are many shallow hollows and ditches that make notogastral surface uneven. Though, in this paper, these hollows and ditches are conveniently named as follows, the author does not consider these terms completely ade-

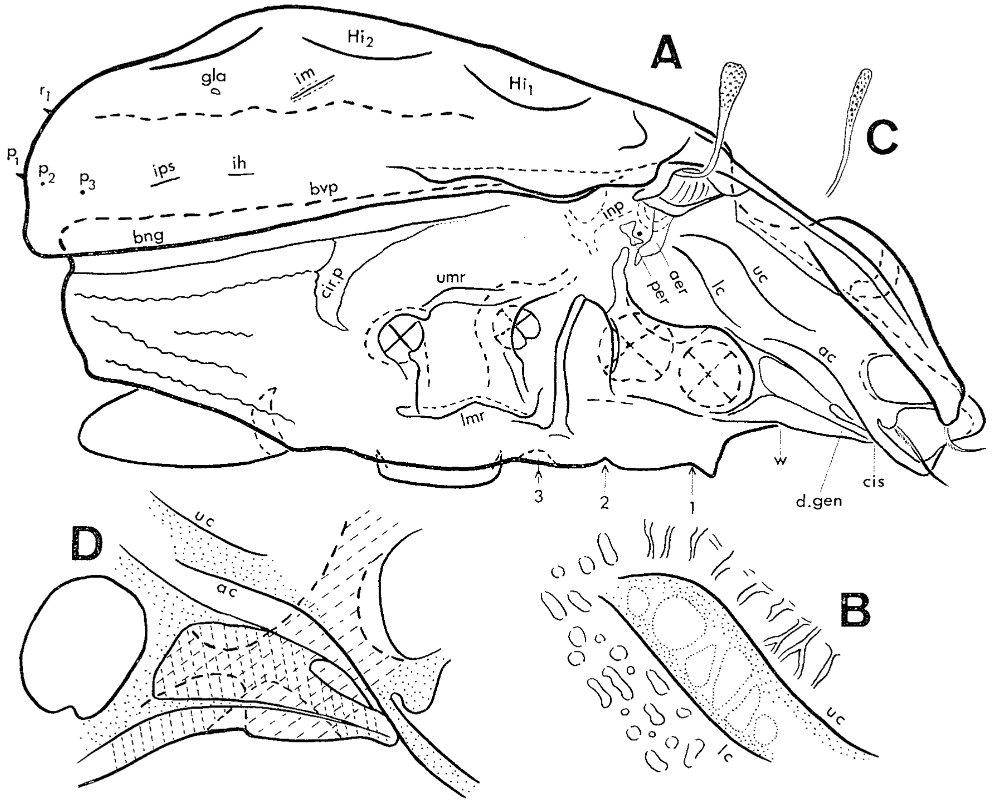

Fig. 2. *Tectocepheus elegans* sp. nov. —— A, Lateral aspect; B, lateral part of prodorsum; C, sensillus; D, genal process. (ac, anterior carina; aer, anterior exobothridial ridge; inp, internal process; lc lower carina; lmr, lower metapodosomal ridge; per, posterior exobothridial ridge; uc, upper carina; umr, upper metapodosomal ridge).

quate: a pair of anterior hollows *Ha* behind dorsosejugalis; a pair of ditched *Hd* continuous from *Ha*, separating humeral processes; interior hollows Hi_1, Hi_2 and Hi_3 larger than *Ha*, arranged in two rows; exterior hollows He_1 and He_2 elongate, placed outside the interior hollows; a pair of posterior hollows *Hp* and a posteriormost hollow *Hm* the smallest.

Minute grains all over the notogastral surface, Large to small granules added mainly out of hollows, while few or a few granules in hollows. The largest granules that take a variety of shapes scattered mainly around *Ha* and Hi_1. A row of large granules along notogastral border *bng* (Fig. 3 A).

Dorsosejugal suture disappearing behind interlamellar setae and broadly absent medially. The position of its disappearing part is clarified by a narrow, arched region where granules are absent.

Humeral process well developed. It has three projecting points as HAARLØV (1952) pointed out in *T. velatus* and *T. alatus*: anterior projection protruding forward and covering a part of bothridium; median projection the largest, not so pointed but rounded, bending downward; posterior projection protruding ventrolaterally. Contour of humeral process deeply notched in front of anterior projection, gently curved inward between anterior and median projections though rather expanding in dorsal view, gently curved inward between median and posterior projections, and slightly notched behind posterior projection. Posterior region of humeral process behind posterior projection gradually turning into a ridge which lowers its height to vanish finally. There is no granulation on the underside of humeral process.

Notogaster in lateral view shows the highest point betweeen Hi_2 and Hi_3, and its outlines abruptly falls behind Hi_3. An abrupt fall also seen outside either Hi_1, He_1 and He_2. Notogastral border crawled under humeral process, continuing to the base of bothridium.

Ten pairs of notogastral setae minute, bud-like with blunt tip: seta *ta* on humeral process situated at the level of median projection; seta *te* between Hi_1 and He_1; seta *ti* between Hi_1 and Hi_2; seta *ms* surrounded by Hi_2, Hi_3 and He_2; seta r_3 between Hi_3 and He_2; seta p_3 under He_2; setae r_2 and p_2 between He_2 and *Hp*; setae r_1 and p_1 between *Hp* and *Hm*. Setae of group *p* near notogastral border. Positions and mutual distances are as follows: *te* nearer to *ti* than to *ta*; *ti* at a level posterior to *te*, nearer to midline than *ms*; *ms* nearer to r_3 than to fissure *im*, taking more interior position than r_3; r_3 situated at mid-distance between *ms* and r_2; r_2 situated at mid-distance between *ms* and r_1: the mutual distance of p_1 wider than that of r_1 and also wider than the distance between p_1 and p_2; p_2 situated at mid-distance between p_1 and p_3. No notogastral seta grows on a granule.

Fissure *ia* short, parallel to notogastral border, situated near a base of humeral process at the level of median projection (Fig. 3 A). Fissure *im* long, oblique, situated between He_1 and He_2, and buried under granules. Fissures *ih* and *ips* about a half as long as *im*, almost parallel to lateral notogastral border, situated outside He_2. Fissure *ip* about as long as *im*, perpendicular to posterior notogastral border, situated on a ridge brtween He_2 and *Hp*, and between setae r_2 and p_2. Glandular opening *gla* obscure, situated behind fissure *im*, at a level posterior to seta *ms*; it is unnoticeable unless granules are exfoliated. There are many clear spots along the edge of the abrupt fall which is mentioned before; the spots also unnoticeable if granules exist.

Mouth parts. Mentum smooth without granulation. Its anterior border having three small protrusions at middle and both lateral sides. Mental setae *h* minute, directed forward. The setae situated in anterior 1/3 of mentum.

Anterior border of gena obscure. A root of gena long, crooked. Anterior genal seta *a* long, directed forward near the anterior corner of gena. Median infracapitular seta *m* as long as seta *a*, inserted near an outer hind corner of gena; seta *m* emerges at first outward from a gap of a joint between gena and mentum, and soon decumbent, directed forward. Rutellum with a brush and three teeth. Exterior tooth the largest, median one small and interior one flat.

Lateral region of podosoma. The foremost border of podosoma forked to have two aristae (Fig. 2 D). The lower arista or genal process *d.gen* almost wholely observable, while the upper arista is covered by an anterior carina.

Each arista with a longitudinal carina which continues to anterior acetabular tectum 1. Capitular angle *w* in front of a condyle is a posterior corner of genal process. (In this paper, the author treats genal process as podosomatic in origin.)

Pedotectum 1 granulated, semicircular in lateral view, while protruding anterolaterally in ventral view. A strongly sclerotized acetabular tectum 1 sheltered under the circumference of pedotectum 1. Pedotectum 2 strongly developed; the posterior part is rectangular, protruding sideward in ventral view, and is a thick, long wall in lateral view; the anterior part is a thin ordinal pedotectum taking the form of a segment of a circle. Surface of pedotectum 2 also granulated. Border of acetabular tectum 2 not sclerotized. The internal room of acetabulum II the largest. Its sclerotized internal wall continued by an external ridge which extends upward, terminating near posterior exobothridial ridge. Histerosoma strongly constricted between pedotectum 2 and acetabulum III. Posterior part of acetabular tectum 3 elevated, observed as a small protrusion in ventral view. Discidium-like ridge hooked, situated just in front of acetabulum IV. Acetabular tectum 4 well developed behind acetabulum IV. Its upper part extend forward to become a ridge (upper metapodosomal ridge) which is effaced above acetabulum III. There is a conspicuous ridge (lower metapodosomal ridge) under acetabula III and IV. Anterior tip of lower metapodosomal ridge looks like a dull cuspidium. Its anterior part in lateral view bending upward, toward the constriction behind pedotectum 2. A small protrusion directed upward, near posterior end of lower metapodosomal ridge; the protrusion observable also in ventral view. Circumpedal ridge *cir.p* wide, crescent with the surface smooth. Its upper edge long, parallel to the lateral border of ventral plate, while its lower tip is pointed behind acetabular tectum 4. Small granules scattered on the lateral surface of metapodosoma, particularly above acetabular tecta 3 and 4.

Epimeral region and apodemes. Contour of lateral side of epimeral region in ventral view is as follows. Pedotectum 1 rounded, fairly protruding anterolaterally. Pedotectum 2 well developed, nearly rectangular though faintly auriculate. Its anterior half is a real tectum of leg II, while its posterior half is a thick swelling fairly protruding sideward. The latter is well separated from the former by a ridge (inner ridge of pedotectum 2) which transversely extends inward and is extinct behind the proximal end of the base of apodeme 2. Epimeral region narrowed behind pedotectum 2. A deep recess present between pedotectum 2 and cuspidium-like ridge. Lower metapodosomal ridge weakly expanded near leg III, shortly projecting posterolaterally near leg IV, then fairly scooped. The ridge highly relieved.

Epimeral borders are wholely internal structures, so that they cannot be seen under incident illumination. Under transparent illumination, they are observable as follows: Border bo_1 of normal type, smoothly round. Its sclerotization is not strong, so that the border is apt to be overlooked. A pair of border bo_2 long, conspicuous, situated obliquely. Their proximal ends usually connected to each other by a sclerotized bridge or a well developed sternal crossing. Internal sclerotization

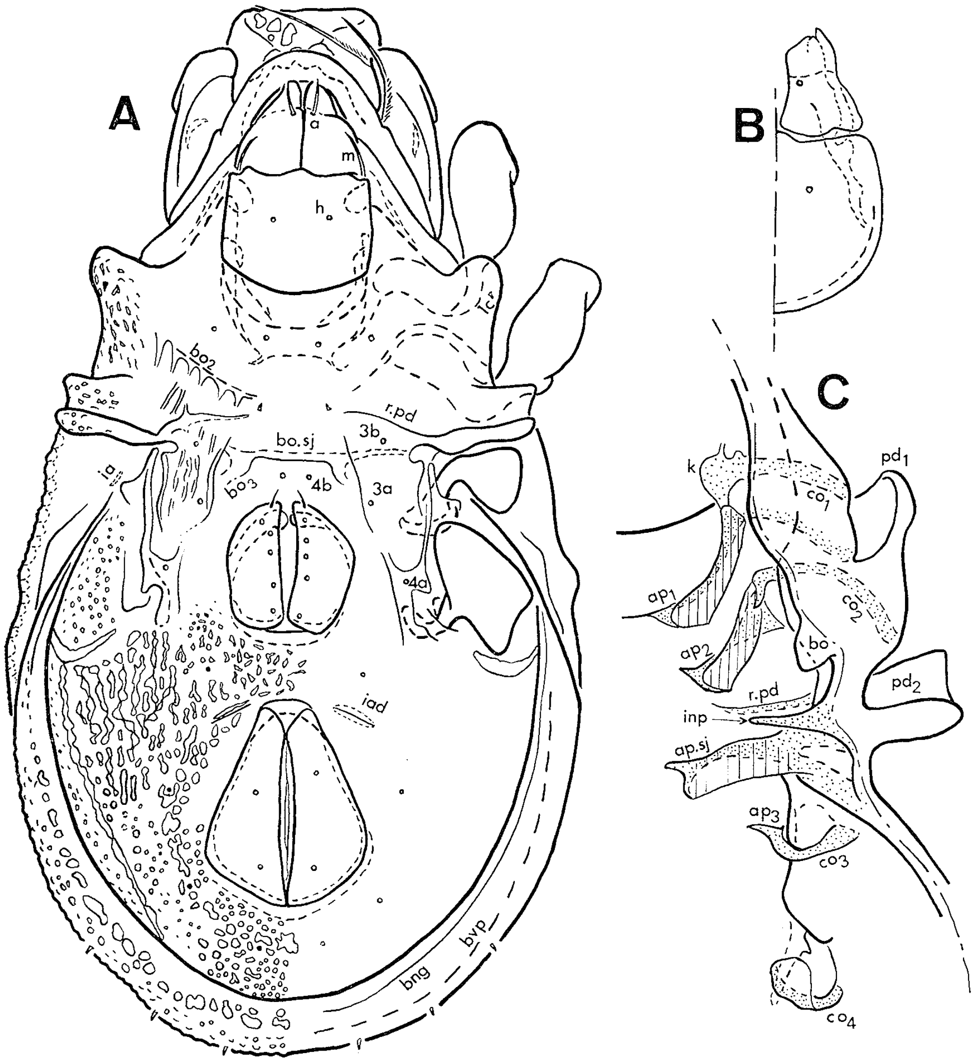

Fig. 3. *Tectocepheus elegans* sp. nov. —— A, Ventral aspect; B, mentum and gena; C, internal aspect of epimeral region (dorsal part of prodorsum and notogaster uncovered). (bo, bothridium; co, cotyloid wall of acetabulum; k, condyle; r.pd, inner ridge of pedotectum 2).

also present along the anterior edge of inner ridge of pedotectum 2. The sclerotization gradually tapers inward. Border *bo.sj* developed only between two bases of sejugal apodeme. Each end bifurcated; the anterior end along sejugal apodeme and the posterior one toward border bo_3. Median part of border *bo.sj* weakly sclerotized. A pair of border bo_3 short. Each of them situated between bases of adodemes *apo.sj* and apo_3. Border bo_4 wide, weakly sclerotized, surrounding anterior edge of genital aperture. The developement of sternal crossing varies from weak to strong. It is usually well developed between two borders bo_2 and at border *bo.sj*. A highly developed one continued from border bo_1 to genital aperture.

Apodemes are thin endoskeletons. Apodeme 1 of normal type, roundly hooked at tip. The base of apodeme 2 attached to border bo_2. The proximal end of the base fairly sclerotized, with a round, internal hook. Sejugal apodeme consists of a well sclerotized triangular plate and a membranous part. The triangular plate continued from a constricted, lateral part of body wall, being perpendicular to epimeral plate. Its proximal vertex situated at the end of border *bo.sj*. Therefore, one side of the triangle is free from the body. A wide membranous belt attached to the free side, extending backward. The proximal end of the base of border *bo.sj* strongly developed. A hook at the tip is also well developed, fusing with epimeral plate. The fusion of the hook makes border *bo.sj* bifurcated. Apodeme 3 situated nearly perpendicular to epimeral plate. Its base short. Apodeme 4 absent.

External structures of epimeral surface are as follows: Epimeral surface slightly concave along border bo_1 (Fig. 2 A, arrow 1). The surface almost smooth in front of border bo_2. The surface fairly lowered just behind border bo_2, so that there is a valley between border bo_2 and the inner ridge of pedotectum 2 (Fig. 2 A, arrow 2). There are 5 to 7 ridges on border bo_2. The proximal ridges shorter, while the antiaxial ones are longer. The ridges connect upper region with the valley like a playground slide. The valley runs through from right to left, though narrowed at sternal region. The posterior edge of the valley almost straight. Between border *bo.sj* and genital aperture, epimeral surface fairly hollowed to make a basin (Fig. 2 A, arrow 3). A pair of plate-like zone extends backward from the base of pedotectum 2. Each zone surrounded proximally by borders *bo.sj* and bo_3, antiaxially and posteriorly by the lower metapodosomal ridge and its branching ridge respectively. The zone contains about 5 rows of ridges each of which is arranged longitudinally. Its anterior antiaxial corner scooped. As mentioned before, a ridge branched forward from a posterior part of lower metapodosomal ridge. Epimeral surface without granules near sternal region and around genital aperture.

Epimeral setae minute. Setal formula 3–1–2–2. Mutual distance of setae *1a* slightly narrower than the distance between setae *1a* and *1b*. Seta *1c* situated on pedotectum 1. Seta *2a* behind the proximal end of bo_2, directed forward since it is situated on a posterior slope of the valley; their mutual distance wider than that of setae *1a*. Seta *3a* near a posterior proximal corner of a plate-like zone. Seta *3b* on anterior part of the plate-like zone. Seta *4a* near a posterior branching point of lower metapodosomal ridge. Setae *4b* in a basin behind border *bo.sj*.

Ano-genital region. Genital aperture with five rounded corners. Genital plates smooth. Their front and hind margins more darkened. Each plate with 6 setae which are arranged in an almost straight row along the median margin. The foremost seta directed forward from the edge, fairly thicker and about four times longer than the other thin, minute setae. The 3rd, 4th and 5th setae situated in anterior 1/3, 1/2 and 2/3 of genital plate, respectively. The region around the aperture faintly darkened widely.

The margin of anal aperture fairly sunk into the body. Anal aperture nearly pear-shaped, having a triangular preanal plate. Anterolateral margins straight. Anterior part of the aperture having two margins: external margin M-shaped, while internal margin is round; internal margin covered by anal and preanal plates. Anal and preanal plates almost smooth. Anal plates convex, the most heightened at the level of the broadest part. Each plate with 2 minute setae near median margin. Anterior setae situated near the level of setae ad_3, while posterior setae are near the posterior margin of the plates. The mutual distance of the former is slightly wider than that of the latter. The region around the aperture colored, especially darker anteriorly and posteriorly.

Adgenital setae minute, situated at a level a little closer to genital than to anal aperture. The mutual distance of the setae as wide as the breadth of anal aperture. Adanal setae minute. Seta ad_3 situated at a level a little closer to anterior end of anal aperture than to posterior one. Setae ad_2 at posterior level to the aperture. Seta ad_1 more distant from aperture than is seta ad_2. The mutual distance of setae ad_3 is about 1.4 times wider than the breadth of anal aperture, that of setae ad_2 1.2, and that of setae ad_1 0.4.

Adanal fissure *iad* long, situated at an angle of about 70° to the body axis. Its surface structure is a mere linear crack which is situated among granules, while its whole shape of the internal part is elongate-oval.

Ventral surface corrugated by some, low, gently-sloping ridges of waves. A pair of exterior ridges conspicuous, along lateral border of ventral plate *bvp*. An interior ridge, U-shaped, surrounding anal aperture; adanal setae situated on a crest of the ridge. The border of ventral plate is a sclerotized frame.

Medium to small granules scattered on ventral plate. They are connected to one another by fine lines. The granules larger behind circumpedal ridge, while smaller between exterior ridge and lateral border of ventral plate. Granules obscure between genital and anal apertures. The granules apt to be fused on the crests of the ridges; the fusion looks like sclerotization. The distribution of granules is dense between genital and anal aperture, and behind anal aperture.

Type-series. Holotype (NSMT–Ac 9204, on slide): Mt. Kyô-ga-mine, Age-gun, Mie-ken, June 17, 1976, extracted from litter. Paratopotypes (5 on slides): June 17, 1976 and April 12, 1980. All deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo.

Remarks. Though each *Tectocepheus* species has many characters of its own, it is true that some of them so closely resemble one another. Therefore, certain species must not be identified by a few restricted characters. The present new species is easily distinguishable from the other known species by a fence-like rostral appendage, and is determined by the following combination of features: 1) rostral margin smoothly rounded between rostral setae, 2) lamella well developed, 3) tip of cuspis rounded without acute projection, 4) posterior dorsal surface of prodorsum with many transverse rows of irregular granules, 5) prodorsum fairly concave in front of dorsosejugalis, 6) interlamellar seta situated on a small ridge, 7) notogastral hollows distinct, 8) granules on notogaster larger and irregular, 9) humeral process separated by a ditch, 10) anterior projection of humeral process fairly protruding, 11) median projection of humeral process not so protruding, 12) setae *ti* and *ms* posteriorly situated, 13) pedotecta 1 round, 14) pedotecta 2 fairly developed, directed far sideward, 15) setal formula of epimerata 3–1–2–2, 16) setal groups 3 and 4 of epimerata characteristically positioned, 17) circumpedal ridge wide, 18) fissure *iad* oblique, and 19) interlamellar, notogastral, mental, epimeral and genito-anal setae very minute.

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REFERENCES

AOKI, J., 1977. Identification of oribatid genera from Japan. *In*: SASA, M., and J. AOKI (eds.), *Contributions to Acarology in Japan*, 179–222. Zukan-no-Hokuryukan, Tokyo. (In Japanese.)

BERNINI, F., 1973. Notulae Oribatologicae VII. Gli Oribatei (Acarida) dell'isolotto di Basiluzzo (Isole Eolie). *Lav. Soc. It. Biogeogr.*, (n. s.), **3**: 353–480, pls. 1–17.

HAARLØV, N., 1952. Systematics and ecology of the genus: *Tectocepheus* BERLESE 1896 (Acarina). *Ent. Medd.*, **26**: 424–437.

KNÜLLE, W., 1954. Die Arten der Gattung *Tectocepheus* BERLESE (Acarina: Oribatei). *Zool. Anz.*, **152**: 280–305.

MORITZ, M., 1968. Neue Oribatiden (Acari) aus Deutschland IV. *Tectocepheus bisignatus* nov. spec. *Zool. Anz.*, **181**: 76–81.